five years, the *Astronomical Journal* again made its appearance under his editorship, and seems likely to have a long and prosperous career.

Although Dr. Gould's reputation as an astronomer will probably rest on the manner in which he carried to a successful issue long, and even wearisome, undertakings, involving continual repetitions of the same processes (witness the Cordova Zone Catalogue and the long series of longitude determinations), it must be admitted that he was keen to recognise the merits of new developments. He must be regarded as one of the first, if not *the* first, to foresee the practical advantages of the application of photography to the accurate determination of star places. So far back as 1866, he had co-operated with Mr. Rutherfurd in photographing the Pleiades, and had deduced the positions of some fifty stars in this group, clearly demonstrating the smallness of the average error of measurement, and the possibility of using those measurements in cosmical inquiries. Later he measured the relative coordinates of the stars in the Præsepe cluster, and the plan of operations proposed for the conduct of the Cordova observatory orginally contemplated the employment of photographic apparatus. The disappointment that Dr. Gould suffered on finding the object-glass broken on its arrival at Cordova is a matter of history, and his heroic attempts to repair the mischief show how fully he appreciated this line of investigation and his eagerness to promote it.

W. E. P.

NOTES.

We referred last week to a very unworthy insinuation, contained in a leading article in the *Times*, that Lord Rayleigh had retired from the Council of the Royal Society owing to a want of sympathy with, or a want of respect for, his colleagues. Lord Rayleigh has since sent the following letter to the *Times*.

> "Sir,—In your issue of Tuesday, after some too flattering remarks regarding my tenure of office, you say that I have taken the unusual step of declining to sit on the Council, and that no one who knows the play of forces within the Society can doubt that my refusal is significant. There seems to be here a suggestion that my retirement is due to a difference with my colleagues —colleagues with whom I have worked for eleven years in complete harmony, and for whom I retain the highest regard.
>
> Permit me to say that my retirement is significant only of a desire to escape engagements involving journeys to London, and of a possibly mistaken impression that the position of an ex-Secretary as an unofficial member of Council would be a little anomalous. "I am, Sir, yours faithfully,
>
> "Dublin, December 2." "Rayleigh.

The Davy-Faraday Research Laboratory of the Royal Institution, founded by Dr. Ludwig Mond, F.R.S., will be opened by the Prince of Wales on Tuesday afternoon, December 22.

The first instalment of the Austin Corbin herd of buffalo, twenty-five in number, has just been removed from the Corbin Estate, in New Hampshire, to Van Cortlandt Park in New York City.

The eleventh German Geographical Congress will be held at Jena on April 21, 22, and 23. The papers and discussions will principally refer to polar investigations, physical geography, biological geography, the topography and natural history of Thuringia, and the teaching of geography in schools.

The death is announced of Dr. Karl Sebastian Cornelius, the author of many works on physics and physical geography, and privat-docent, with the title of Professor, in the University of Halle. We also notice the death of the zoologist, Dr. Fritz Westhoff, of the Königl. Akademie at Münster.

Mr. P. F. Cook sailed for Hamburg a few days ago in the interests of the American Colonisation Society and of the Smithsonian Institution. He will remain a month at the Hague, studying myriapods and insects, and will then proceed to Siberia for a residence of several months, to conduct investigations of scientific and economic matters.

The Liverpool Chamber of Commerce has unanimously adopted a resolution in favour of the adoption of the metric system of weights and measures, and urging that at the earliest possible moment consistent with the public convenience a Bill should be brought in to make the system compulsory.

Dr. Bernard Dyer has been elected President of the Society of Public Analysts for the year 1897. The newly-nominated Hon. Secretaries are Mr. E. J. Bevan and Mr. Charles E. Cassal.

With reference to our note of November 19 (p. 58), on the "Welby Prize," we are requested to announce that, in consequence of unforeseen delays, it is found desirable to extend the time allowed to competitors till January 1, 1898, and that Prof. Émile Boirac, Paris, becomes the French member of the Committee of Award.

After an absence of three years, the expedition under Lieut. Hourst has safely returned to Europe from the Niger. The party ascended the Senegal River, and then carried the section of an aluminium boat overland to the upper part of the Niger. On reaching this river the pieces of the boat were put together, and two native boats purchased. In these the expedition sailed down the Niger to Timbuctoo, where a stay of ten months was made. The voyage from Timbuctoo to Lokoja, at the confluence of the Niger and Benue, seems to have been arduous, but from that point the expedition was towed by a launch belonging to the Royal Niger Company to the coast at Wari. How much fresh topographical information Lieut. Hourst's party has obtained is not yet stated; this will depend on the highest point reached on the Niger. Reuter's message states that the expedition "first met the river Niger at Kayes"; but that town is on the Senegal River. There can be no doubt, however, that much valuable scientific information was obtained, for the expedition travelled slowly, and was admirably equipped. One novelty was the use of a phonograph for reporting the native war songs. The expedition kept peace with the natives throughout the journey, in which it differs greatly from some of those previously conducted by French explorers in that region.

The success which has attended the installation of a meteorological observatory on the summit of Mont Blanc has (says the *Daily Chronicle*) stimulated Italian men of science to crown Monte Rosa with a similar edifice. Queen Margherita, herself an expert mountaineer, supports the project by a donation of 160*l.*, the Duke of the Abruzzi gives 200*l.*, and the Italian Alpine Club, the Ministers in their private capacity, and the physical faculty of the University of Turin figure among its chief contributors. It is intended to utilise the hut on the Gniffetti peak, built three years ago as a shelter for climbers. Situated at a height of about 14,000 feet above sea-level, the observatory will, as regards elevation, rank fourth among the twenty-seven mountain observatories of the world, being surpassed in altitude only by those of Arequipa, Mont Blanc, and Pike's Peak.

In 1897, for the first time since the British Medical Association came into existence, the annual meeting will be held outside the British Isles. In order to induce as many members of the Association as possible to decide to go to Canada next year, the *British Medical Journal* prints an illustrated article in the curren number, showing the extensive preparations already comenced at Montreal, and giving valuable details as to ways of reaching the Dominion, and the cost of the journey. It may be remembered that the Association will meet on Tuesday, August 31, and three following days. This date has been decided upon for several reasons, the most important being that the British Association meets in Toronto from August 18 to 27. It will thus be possible for those who can spare the time to attend both meetings.

It is proposed to hold an international electrical exhibition at Turin in 1898. The Executive Committee and the Special Commission invite exhibits from all parts of the world, and the exhibition will comprise the following classes: (1) Apparatus for teaching electro-technics; (2) materials for the conduction of electricity; (3) instruments for electric and magnetic measurements; (4) telegraphs and telephones; (5) signalling apparatus and safety appliances on railways, lighting and heating of carriages; (6) dynamos and motors; (7) mechanical appliances and electric traction; (8) electric lighting; (9) electro-chemistry and electro-metallurgy; (10) miscellaneous; (11) apparatus of historic interest. Signor Galileo Ferraris has been appointed President of the Commission.

During the past week this country has been visited with very severe gales, the greatest violence of which seems to have been felt on the South Coast. The reports issued by the Meteorological Office show that on the morning of the 4th instant the centre of a very deep depression suddenly appeared near the mouth of the English Channel, and advanced eastwards to the Channel Islands, where the barometer fell as low as 28·32 inches. During the night the storm changed its direction and moved northwards over England, while the wind increased to a whole gale from the southward, accompanied with heavy rain, and very high seas. In the neighbourhood of London the maximum wind force was registered at about 1 a.m. on the 5th, or between two and three hours after the time of the destruction of the Chain Pier at Brighton. The pressure recorded by the anemometer at the Royal Observatory was 18 lbs. on the square foot, which is equivalent to a velocity of about seventy-eight miles in the hour.

The death of Prof. Emil von Wolff, in his seventy-eighth year, has just taken place at Stuttgart. The *Times* gives the following particulars of his career: "Born at Flensburg in 1818, he took his doctor's degree in the University of Berlin in 1843, and in the same year he was appointed assistant in the chemical laboratory in the University of Halle. Four years later he became instructor in chemistry at the agricultural institute at Brösa, near Bautzen. After passing some years at Möckern, near Leipzig, at the first agricultural experiment station ever founded in Germany, he was in 1854 called to the chair of Agricultural Chemistry at the Royal Agricultural College, Hohenheim, Wurtemberg. This post he retained for the rest of his life, so that he occupied the chair for a period of forty-two years. In 1868 he published a work dealing with practical systems of manuring, and six years later appeared the work which has made his name known throughout the world; this was his 'Landwirtschaftliche Fütterungslehre,' in which he dealt with farm foods and the rational feeding of farm animals. Since then the work has run through half-a-dozen editions, and has been translated into various languages, though long before any complete translation was attempted his tables of analyses of foods had been adapted to and incorporated with many volumes published in England, France, and the United States. As an authority on animal nutrition and the composition of foods Wolff stood pre-eminent, and all of the methods of the so-called rational feeding of live stock trace their origin to him and to the enthusiasm of the many students whom he trained during the last half-century."

A competition between heavy vehicles propelled by automatic traction is being organised by the Automobile Club of Paris; and in order that the makers of all kinds of cars, waggons, and similar vehicles should have plenty of time to prepare for the contest, which is open to all the world, the official programme has already been issued. The contest is to be for vehicles transporting passengers and goods on the high roads not in direct communication with railways, and it is to be held over roads in the vicinity of Paris on July 1, and five following days. A committee will be appointed to see how the competing vehicles work, whether they stop readily on the inclines, what speed they attain up and down hill, and, in a word, to judge how far they are likely to be of practical use. The prizes will be awarded with special reference to these qualifications. In order further to encourage makers of motors to compete, the Automobile Club will prepare an official report of the trials, and send it to all the civil engineers, industrial companies, and mayors in France. Entries may be made, and full particulars obtained from the Secretary of the Automobile Club, Place de l'Opéra, Paris.

At the Royal Institution, on Monday, the special thanks of the members were returned to the Duke of Northumberland, K.G., President of the Institution, for a donation of 200*l.* to the fund for the promotion of experimental research at low temperatures; to Colonel Coleridge Grove for a bust of his father, the late Sir William Grove; and also to Prof. Dewar, for a marble pedestal for the bust. The following are among the lecture arrangements at the Institution before Easter:—Prof. S. P. Thompson, six lectures (adapted to a juvenile auditory) on light, visible and invisible; Prof. Augustus D. Waller, twelve lectures on animal electricity; Prof. Henry A. Miers, three lectures on some secrets of crystals; Dr. J. W. Gregory, three lectures on the problems of Arctic geology; Prof. Percy Gardner, three lectures on Greek history and extant monuments; Prof. W. Boyd Dawkins, three lectures on the relation of geology to history; Mr. Walter Frewen Lord, three lectures on the growth of the Mediterranean route to the East; and the Right Hon. Lord Rayleigh, six lectures on electricity and electrical vibrations. The Friday evening meetings will begin on January 22, when a discourse will be given by Prof. Dewar; succeeding discourses will probably be given by the Right Rev. the Lord Bishop of London, Prof. Jagadis Chunder Bose, Prof. John Milne, Dr. G. Johnstone Stoney, Lieut.-Colonel C. R. Conder, R.E., Mr. Shelford Bidwell, Prof. Arthur Smithells, Sir Edward Maunde Thompson, Sir William Turner, Mr. Charles T. Heycock, and the Right Hon. Lord Rayleigh.

Some interesting information regarding the effects of inoculation for cholera is to be found, according to the *Pioneer Mail*, in the report on the railway reconnaissance from Assam to Burmah *viâ* the Hukong valley. Mr. Way, the engineer-in-chief, had to engage coolie transport, and 357 Khasias were collected at Margherita. Cholera was raging in the neighbourhood at the time, and, in spite of all precautions, the coolies were attacked. Fortunately, Surgeon-Captain Hare was at Dibrugarh, engaged in the special duty of inoculating labourers on the tea gardens, a work which had been begun by Dr. Haffkine some time before. He willingly agreed to deal with the Khasias, and the majority of them submitted to inoculation. The effect was very marked; the deaths among the inoculated were only 2·55 per cent., while among the uninoculated they came to nearly 19 per cent. The disease made such ravages among the latter that the coolies themselves became thoroughly convinced of the efficacy of inoculation, and finally all agreed to undergo the treatment. From that time onward no fresh cases of cholera occurred. Dr. Hare states that the 52 men first dealt with formed a separate group messing together in the same sheds. Of these, 30 were inoculated and 16 left; of the 16 uninoculated, 11 developed cholera and died; among the 36 there was only one case, but this terminated fatally. There seems to be no room for doubt that if all the coolies had been inoculated at the outset the disease would have ceased in a few days.

The Maryland Geological Survey, in an endeavour to make its work fundamental, and at the same time of the greatest value to the material interests of the State, has taken up, in its preliminary investigations, a thorough study of the magnetic conditions affecting that portion of the earth's crust within the borders of Maryland. In addition to the importance of this work upon the future observations and determinations of the great rock-masses contained within the State, these investigations will be of immediate practical benefit to all land surveyors, and from that standpoint alone justify the undertaking. We learn from an advance sheet from *Terrestrial Magnetism* that the investigations are being conducted by Dr. L. A. Bauer, under the direction of the State Geologist, Prof. W. Bullock Clark. The Survey will ultimately average one station to about 140 square miles, thus equalling in detail that of Rücker and Thorpe in the British Isles. There is probably no State in America that presents, within so small an area, such a variety of geological formations as Maryland. It is then peculiarly fortunate that a detailed magnetic survey has been undertaken in this State, and simultaneously and in connection with the Geological Survey. It is hoped that other States will soon follow the example set by Maryland.

At a recent meeting of the Otago Institute, Mr. G. M. Thomson exhibited some interesting fossil remains obtained from a mining claim at St. Bathans. The fossils occurred in a bed of hard clay which was overlaid by 30 feet or 40 feet of lacustrine (marine?) clays. They consist of leaves and fruit capsules of a species of Hakea. The genus Hakea belongs to the order Proteaceæ, and is at present confined to Australia, where about 100 species are known. Of these sixty-five have only been found hitherto in West Australia. The occurrence of the genus in New Zealand in Tertiary times is of great interest in its bearing on questions of geographical distribution.

Amongst the things recently exhibited at the opening meeting of the Geologists' Association and at the "at home" of the Geological Society, one that deserves attention was shown by the Geological Photographs Committee of the British Association. Several portfolios were exhibited which contained the prints recently acquired by that body, among them being a fine set of views of the Yorkshire Coast taken by Mr. Bingley, a large series of small photographs taken during the recent re-examination of Charnwood Forest by the Geological Survey, and some most useful prints showing the chalk of Beer and the landslips of that neighbourhood, taken several years ago by Sir Henry T. Wood. The whole collection, now numbering about 1400 photographs, is lodged in the library of the Jermyn Street Museum, where it is borne company by the Survey collection of prints taken and acquired by the officers of the Geological Survey, the two collections supplementing one another. Although so much has been done, the labours of the Committee are by no means over, and many parts of Britain still need to be surveyed by the camera. Many local bodies have given ready aid to the work, and they must still be looked to to watch for phenomena which ought to be registered, and to help in keeping the collection up to date. It is hoped that this may come to be a recognised part of the work of local societies, and no pains are being spared to enlist the services of new societies, and to encourage those which have begun, to continue in their good work. Among the districts scarcely, if at all, represented at present in the collection are the following:—Bedford, Bucks, Berks, Cambridge, Cumberland, Essex, Gloucester, Hants, Hereford, Herts, Huntingdon, Lincoln, Middlesex, Monmouth, Norfolk, Northants, Nottingham, Oxford, Rutland, Stafford, Suffolk, Surrey, Sussex, Warwick, Westmoreland, Wiltshire, Worcester, South and Central Wales, Scotland, except parts of the Highlands and of the Central Valley, S.E., S.W., W., and Central Ireland. It is true that some of these districts do not lend themselves so well as others to this method of illustration, but what work there is should be done without delay. There will thus be got together a set of illustrations which will be a most valuable addition to published maps, sections, papers, and memoirs, and one which will in many respects remedy the deficiencies and supply the omissions of the methods of illustration usually employed.

Prof. E. Villari describes (*Atti dei Lincei*, v. 8) some fresh experiments relating to the property possessed by Röntgen rays of inducing in gases the power of discharging electrified bodies. This power is found to persist for a certain time after the rays have ceased, and it is not altogether destroyed, although considerably reduced, by causing the gases to flow through a tube several metres long. Sparks from an induction coil, whether reinforced by a condenser or not, are found to impart the same discharging power to gases, and their efficacy in either case increases at first with the length of the spark; but after a certain length of spark has been exceeded, the efficacy without the condenser decreases to zero. Another series of experiments on the electrostatic dispersion of Röntgen rays is described by Dr. Uno Panichi (*Rivista Scientifico-Industriale*), who examines the question of whether Röntgen rays are emitted from a Crookes' tube after the discharge within the tube has ceased. Dr. Panichi finds that within 1/50 of a second from the termination of the discharge, the Crookes' tube has no effect whatever on an electroscope, so that any after-effects which may be observed in other experiments must be due to the aforementioned modifications in the air which has been traversed by the rays.

The January number of *Science Progress*, which now appears quarterly and in an enlarged form, will contain important and interesting articles on "Liquid Crystals," by Prof. H. A. Miers, F.R.S., Professor of Mineralogy in the University of Oxford; on "Selection in Man," by Dr. John Beddoe, F.R.S.; on "The Glossopteris Flora," by A. C. Seward, Lecturer on Botany in the University of Cambridge; on "Condensation and Critical Phenomena," by Dr. E. T. Kuenen.

A complete list of the scientific writings of the late Prof. Adolfo Bartoli has been compiled by Dr. Carlo del Lungo, and is published in the *Rivista Scientifico-Industriale* for August–October 1896.

From Profs. Elster and Geitel, we have received a copy of their important paper, published in the current volume of *Wiedemann's Annalen* (pp. 487–496), on the photo-electric after-effects of kathodic rays.

The snakes found within fifty miles of New York City are enumerated by Mr. R. L. Ditmars, with brief descriptions of the species, and notes on their local distribution and habits, in an "Abstract" (No. 8) of the *Proceedings* of the Linnean Society of New York.

The Deutsche Seewarte has issued the seventh volume of *Ueberseeische meteorologische Beobachtungen*, containing actual readings and monthly results of various stations in distant parts of the globe. The observations in Labrador are especially interesting to students of weather sequences which may affect this country, as many areas of low barometric pressure between Canada and the North Atlantic Ocean take their course over that peninsula. In addition to four stations in Labrador, the present part contains observations from Walfish Bay, Samoa, and German East Africa—altogether twelve stations. The observations are made with trustworthy instruments, and by competent observers, and form a valuable contribution to meteorological knowledge.

Prof. A. Klossovsky, Director of the Meteorological Service of the South-east of Russia, has sent us a *résumé* of work done during the last ten years. The headquarters of the Service is established at the magnetical and meteorological observatory of Odessa; this institution was founded by the Minister of Public Instruction, and has an annual allowance from the local municipal authorities. The main credit for the establishment of the system is due to Prof. Klossovsky, who for some years maintained it by his own exertions, being of the opinion that in so large a country as Russia, investigations of this nature, intended chiefly for the benefit of agriculture, cannot be managed and controlled by the central office at St. Petersburg. At the present time Prof. Klossovsky has enlisted the services of nearly 1000 observers, who deal more especially with rainfall, hail and thunderstorms. In addition to the yearly volumes of results, several investigations of considerable importance have been published.

Physical chemists have been anxiously awaiting the publication of the sections on chemical affinity required to complete the second enlarged edition of Dr. Ostwald's indispensable "Lehrbuch der allgemeinen Chemie" (Wilhelm Engelmann, Leipzig). This branch of the subject has been left for the second part of the second volume; and the first instalment of that part, dealing almost entirely with the history of chemical affinity, has just been published. It is expected that the treatment of the subject will occupy four or five instalments of about the same size as the present one, which runs into 208 pages, and all of them will be published in the course of next year. We propose to await the completion of the work before reviewing it, and at present content ourselves with announcing the appearance of one instalment.

The December number of the *Geographical Journal* is full of interesting papers and notes. Mr. Montefiore Brice's account of the work of the Jackson-Harmsworth polar expedition, read before the Royal Geographical Society on November 10, is printed in full with illustrations, and appended to it is a report by Mr. Harry Fisher, the botanist to the expedition, on the flora of the Franz Josef Archipelago. Prince Henri d'Orleans describes his journey from Tonkin by Tali-fu to Assam. The eruption of Ambrym Island, New Hebrides, South-west Pacific, in 1894, is described, and illustrated from photographs, by Commander H. E. Purey-Cust, R.N. Mr. John L. Myres' paper, in which he gives an account of an attempt to reconstruct from the text the maps used by Herodotus, is very suggestive. Among the notes we observe the announcement that the Council of the Society not only intends to present Dr. Nansen with a special gold medal for his recent Arctic expedition, but also to award silver replicas of the medal to Captain Sverdrup, Lieut. Scott Hansen, Lieut. Johannesen, and Dr. Blessing, and replicas in bronze to the other members of the expedition.

The effect of pressure on the velocity with which acids bring about the inversion of cane-sugar has recently been the subject of several investigations. It is well known that, at atmospheric pressure, the velocity of inversion is very nearly proportional to the degree of electrolytic dissociation of the acid used. Further, the degree of dissociation of acids increases, in general, with increasing pressure; it might thus be supposed that the rate of inversion of sugar under the influence of acids would do so also. Röntgen found that with strong, *i.e.* almost completely dissociated acids, the contrary was the case. Rothmund confirmed this result, but showed that if ethyl acetate be substituted for sugar, the velocity of change is increased by pressure, possibly owing to the sugar being changed into a less, and the ethyl acetate into a more easily hydrolysed modification. A further addition to our knowledge of the matter is made by O. Stern, in the current number of *Wiedemann's Annalen*. He finds that the rate of inversion of sugar by weak acids (acetic and phosphoric) is increased by pressure, while with strong acids (hydrochloric, sulphuric, and oxalic) it is decreased. The author gives his results without comment; it is, however, striking that an increase of velocity is found only with the weak acids, *i.e.* those which are dissociated into their ions, under ordinary pressure, to a small extent only; with these acids a considerable increase in the number of dissociated molecules is possible; with the strong acids, however, this is not the case, because they are almost completely dissociated at ordinary pressure. Taking into account the influence which the pressure has on the body undergoing hydrolysis, some sort of interpretation of the results may be given.

Within the past few days, a number of new editions of scientific books have been received. Messrs. C. C. Hawkins and F. Wallis's simple and accurate volume on the theory, design and manufacture of "The Dynamo" (Whittaker and Co.) has passed into a second edition. The book well combines the theoretical and practical sides of electricity.—"Select Methods in Inorganic Quantitative Analysis," by Prof. Byron W. Cheever, has been revised and enlarged by Prof. Frank C. Smith, and the third edition is now published by Mr. William F. Clay, Edinburgh. In this volume the methods to be followed in the chemical analysis of a set of substances are described, and also the methods of calculating and preparing volumetric standard solutions. The contents thus provide a beginner's course of gravimetric and volumetric analysis.—Another, but much larger, manual to assist beginners in the practice of quantitative analytical chemistry, is "A Manual of Quantitative Chemical Analysis" (Henry Holt and Co., New York), by the late F. A. Cairns, the third edition (revised and enlarged) being by Prof. Elwyn Walker. The book was first published in 1880, and the important changes and advances which have been made since then have necessitated a very thorough revision. The chief feature of the work is mineral analysis, and in the treatment of this branch of analytical practice, as well as of others, students will find very helpful instructions, whilst from it professional chemists will derive useful suggestions.—Messrs. Longmans, Green, and Co. have just published a new and enlarged edition of Mr. G. S. Newth's excellent volume on "Chemical Lecture Experiments." The work contains full directions for the preparation and performance of experiments for illustrating, in lectures, the properties of the non-metallic elements and their more important compounds. Most teachers of chemistry know Mr. Newth's very serviceable volume; those who do not, should hasten to make themselves acquainted with it.

All the physical geography required by pupil-teachers and masters in elementary schools is set forth in an orderly manner in "Graphic Lessons in Physical and Astronomical Geography," by Mr. Joseph H. Cowham. The book, which is published by the Westminster School Book Depôt, and by Messrs. Simpkin, Marshall, and Co., is now in its sixth edition. The lessons in it are admirably arranged, the important points in each of them being given prominence. The illustrations are very instructive, and most of them are suitable for sketching upon the blackboard. In fact, the book furnishes strong evidence of the attention paid by the author to the methods of teaching his subject, as well as to the subject itself.—The tenth edition of "The Pocket Atlas of the World," by Mr. J. G. Bartholomew, comes to us from Messrs. John Walker and Co. The "Atlas" has been greatly amplified and extended. Without increasing its bulk, seventy-two new plates have been added; the text has been rewritten, and the maps revised to the date of issue.—"A Text-book of Shades and Shadows and Perspective," prepared for the use of students in technical schools, by Prof. John E. Hill, has reached a second edition. The book, which is published by Messrs. John Wiley and Sons, has been thoroughly revised and, in the main, rewritten.—Messrs. Cassell and Co. have commenced the issue of a cheap edition of their "Technical Educator." The parts will appear weekly, and each will contain ninety-six pages of text and illustrations.

THE additions to the Zoological Society's Gardens during the past week include two White-thighed Colobus (*Colobus vellerosus*, ♂ ♀), a Campbell's Monkey (*Cercopithecus campbelli*, ♂), a Green Monkey (*Cercopithecus callitrichus*, ♂) from West Africa, presented by Dr. S. H. Armitage; a Lesser White-nosed Monkey (*Cercopithecus petaurista*) from West Africa, a Black-headed Lemur (*Lemur brunneus*) from Madagascar, presented by Miss Baird; an Arabian Gazelle (*Gazella arabica*, ♂) from Arabia, presented by Mr. R. G. Buchanan; two Raccoons (*Procyon lotor*) from North America, a Golden Eagle (*Aquila chrysætus*), a Buzzard (*Buteo vulgaris*), European, presented by Lord Arthur Cecil; two Laughing Kingfishers (*Dacelo gigantea*) from Australia, presented by Mr. F. Beaumont; five Eyed Lizards (*Lacerta ocellata*), European, presented by Mr. P. Goupille; a Thick-necked Tree Boa (*Epicrates ceuchris*) from Tropical America, deposited.

OUR ASTRONOMICAL COLUMN.

LEONID METEORS IN AMERICA.—The display of meteors on November 13 and 14 is said to have been great at some places in America. Published accounts include the statement that as many as twelve at a time were seen; and a press dispatch from Indianopolis states that meteors were visible there in broad daylight, in fact about the middle of the day.

A NEW SPECTROSCOPIC BINARY IN PUPPIS.—A new addition has recently been made to that class of stars of which ζ Ursæ Majoris, β Aurigæ, and μ' Scorpii are the present members. The star in question is Lacaille 3105, A.G.C.10534, and the Draper Memorial photographs show that it is a binary, its photometric magnitude being 4·50 (*Harvard College Obs. Circular*, No. 14). Prof. E. C. Pickering first noticed its binary character in February of last year, and this has been corroborated by several photographs secured by Prof. Bailey. A discussion of all the photographs taken, gives the length of the period as 3d. 2h. 46m., the formula representing the times of inferior conjunction being given as J.D. 2412777.16 + 3·115 E.

At these times the lines in the spectrum are said to be single; for the next thirty-seven hours they are double, the fainter component of each having a greater wave-length than the brighter component. The lines then again become single, and finally double for the remainder of the period, the fainter components having shorter wave-lengths, and being therefore towards the violet end of the spectrum.

RELATIVE MOTION IN THE LINE OF SIGHT.—In a *Harvard College Observatory Circular* (No. 13), Prof. E. C. Pickering describes a new method by which the relative motion of stars in the line of sight may be determined by means of the objective prism. As yet only preliminary trials of this method have been made, but it promises, as we are told, to be fairly satisfactory. In a discussion with Mr. E. S. King, of the experiments made by comparing the corresponding lines in the spectra of different stars with their images taken on another plate without the prism, and with the film reversed, the following process was evolved. It may be briefly summed up as follows. Two stars which are close enough to be photographed on a single plate are first selected. Let one of these be supposed at rest, and the other moving, say, towards the observer with a velocity represented by a deviation of amount d in its spectrum. If a photograph be taken such that the end of the shorter wave-length of the moving star be turned towards that of the star at rest, the distance between the images of a given line in the two spectra will be lessened by the amount d. By turning now the prism through 180°, the spectra will also be rotated through the same amount, and the end of greater wave-length of the spectrum of the moving star will now be turned towards that of the star at rest. If a photograph be taken in this position, the distance will in this case be increased by d. By superposing the two photographs thus obtained, making the images of the given line in the spectra of the star at rest coincide, the difference in the readings of the same line in the other spectra gives double the displacement of this line.

In actual practice the photographs can be obtained one on each side of the meridian, the act of reversing the telescope turning the prisms, and with them the spectra, through 180°.

For the examination of the plates, the film sides of the negatives must be placed together to ensure an accurate comparison, thereby necessitating that one of the photographs has to be obtained with the film side *away* from the objective prism. The question of change of focus can here then arise, of which, however, Prof. Pickering makes no mention.

The advantages of this method, as stated by him, may be condensed as follows:—Directness of the determination of the motion. Double the deviation is measured. Accidental errors of measurements are much less than when each in turn is bisected by a spider line, as the ends of two similar lines are made to coincide. Since each line in the spectrum may be used, a large number of independent determinations may be obtained from one pair of plates. Further, a visual telescope may be employed, as it is only *necessary* that one line should be in focus. Corrections for the motion of the sun in space, or of the earth in its orbit, may be disregarded, as they affect both stars equally.

FORMULÆ FOR COMPUTING WAVE-LENGTHS.—By the investigations of several workers the positions of the lines in the spectra of numerous substances are being mathematically determined. It was Lecoq de Boisbaudran who first pointed out the regularity in position in which lines of some substances appeared. Stoney, and others after him, found out that some of the lines of hydrogen were harmonically situated in the spectrum. It was left, however, for Balmer to bring forward a formula by which the wave-lengths of the lines in the hydrogen spectrum could be computed with wonderful accuracy. The formula was as follows:—

$$\lambda = \mathrm{A}\frac{n^2}{n^2 - 4},$$

where n represented the numbers 3 to 15, and A the number 3645·42 in Ångström's units. Cornu at the same time, and Deslandres a year later, worked on this question, the latter producing a formula from which the bands of several elements could be computed.

In 1887 Kaiser and Runge set to work, and between them they advanced the new idea very considerably by describing a general formula which represented a great number of series of different elements, and which also included that of hydrogen, Balmer's formula being found to be only a special case. The new formula became then

$$\tau_n = \mathrm{A} - \mathrm{B}n^{-2} - \mathrm{C}n^{-4},$$

the reciprocal of the wave-lengths (τ_n), instead of the wave-length themselves being here employed. The first three members of such a series sufficed to represent the series of lines with considerable approximation from values obtained from observation, with the exception, perhaps, of the longest and shortest waves. For the determination of these constants, which appear in this formula, three distinct measurements of the number of oscillations are necessary.

The drawback of this formula is that for the longest, or, at any rate, the two longest waves, it is not sufficiently accurate; and, even if more terms were added, the determination of the values of the additional constants would be uncertain owing to the limited accuracy of the wave-length measurements.

In determining the accuracy of this expression, Messrs. Kaiser and Runge were thus led to undertake the investigation of more accurate determinations of the spectra of the elements.

More recently, however, Herr Balmer has succeeded in finding an expression which represents the series with greater accuracy than formerly. This differs slightly from those given above, in that the third term is dispensed with, and an additional constant